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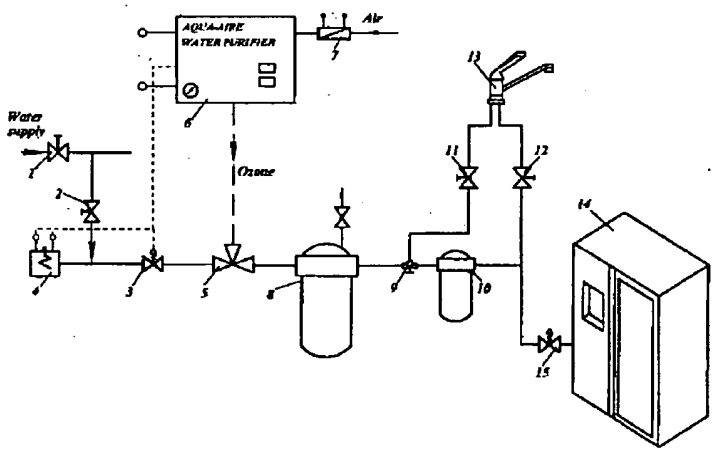
(54) **TRAITEUR PAR OZONE D'APPROVISIONNEMENT EN EAU**
(54) **OZONATED WATER SUPPLY PURIFIER**



(57) Traiteur par ozone d'approvisionnement en eau à double fonction : produire une eau pure et agréable au goût, dépourvue de chlore, d'odeur déplaisante, de couleur, de germes et de bactéries ainsi qu'une eau ozonisée pour des applications domestiques. Le traiteur incorpore le processus de purification de l'eau par ozone à l'approvisionnement en eau municipale de façon que l'eau traitée maintienne le niveau de résidus d'ozone nécessaire à tuer les bactéries sur la peau, dans la bouche, sur les parties intimes du corps, à oxyder les produits chimiques dangereux ou à tuer les bactéries sur la surface des légumes, des fruits, des viandes, de la volaille, des planches à découper, etc. Le traiteur contient des lignes dérivées d'absorption d'ozone et un robinet mélangeur spécial afin de fournir une eau chaude ozonisée pour laver les parties intimes du corps. D'autres applications incluent un approvisionnement d'eau pure pour la machine à glaçons du réfrigérateur et de l'eau ozonisée pour la douche.

(57) An Ozonated Water Supply Purifier is described as a double purpose apparatus for producing pure, tasty, water, free of chlorine, unpleasant odour(s), colour, germs, bacteria and ozonated water for household applications that embodies the water purification process by ozone of the municipal or community water supply in a way that treated water maintains the level of ozone residual which is sufficient to kill bacteria on the skin, in a mouth, on private parts of the body, oxidize the harmful chemicals or kill bacteria on the surface of the vegetables, fruits, meats, poultry, cutting boards, and so on. The said apparatus contains bypass ozone absorption lines and special mixing valve to provide warm like ozone containing water to the washing of private parts of the body. Other applications include pure water supply for the cube ice making in the refrigerator and ozone containing water for the shower.

CLAIMS:

1. Ozonated Water Supply Purifier that provides two streams of ozone treated water - one stream is the high quality drinking water free of the germs, bacteria, chlorine, colour, unpleasant odour(s), and the stream of water containing safe ozone residual that helps to kill germs, bacteria on the skin, in the mouth, on the private parts of the body, when it is applied for personal use.

2. And said Ozonated Water Supply Purifier is invented to be used as a kitchen under the sink appliance to provide pure water for the kitchen ice maker or ozone containing water to wash vegetables, meat, poultry, disinfect cutting boards, cutlery and so on.

3. The apparatus of claim 1 is invented to be used as a household appliance with a storage tank to provide two streams of water flow for the whole house: one stream of the pure high quality drinking water free of chlorine, bacteria, odour, unpleasant colour and the stream of ozone containing water for the sanitation/disinfection purposes.

4. The apparatus of claim 1 embodies the divert valve that allows to divert water flow for the purpose of having choice of ozone containing water for the washing and disinfection and pure water for drinking.

5. In apparatus of claim 1, harmful bacteria does not build up in the filter, reducing filter replacement and maintenance schedule.

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OZONATED WATER SUPPLY PURIFIER

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ABSTRACT

An Ozonated Water Supply Purifier is described as a double purpose apparatus for producing pure, tasty, water, free of chlorine, unpleasant odour(s), colour, germs, bacteria and ozonated water for household applications that embodies the water purification process by ozone of the municipal or community water supply in a way that treated water maintains the level of ozone residual which is sufficient to kill bacteria on the skin, in a mouth, on private parts of the body, oxidize the harmful chemicals or kill bacteria on the surface of the vegetables, fruits, meats, poultry, cutting boards, and so on. The said apparatus contains bypass ozone absorption lines and special mixing valve to provide warm like ozone containing water to the washing of private parts of the body. Other applications include pure water supply for the cube ice making in the refrigerator and ozone containing water for the shower.

5 claims, 5 drawings

BACKGROUND OF THE INVENTION

1. INVENTION FIELD

The invented Ozonated Water Supply Purifier represents the type of apparatus that is designed to produce two streams of the purified water: one is the high bottled quality drinking water and ozonated water that contains safe ozone residual which is sufficient to remove germs, bacteria from the treated surface.

The invented apparatus is intended to be used as a household appliance that connected to the municipal or community cold water supply. The apparatus has two modifications: under-the-sink installation and whole house or cottage installations. Both installations include corona discharge ozonator, injector, pressure switch, storage tank, divert valve and carbon filter. Municipal or community water enter the apparatus through the injector where it mixed with ozone produced on site by corona discharge ozonator. The pressure pushes the water into the storage, contact tank. When the tap is open, the ozonated water rushes into the tap through the divert valve and carbon filter. The water with safe ozone residual could be diverted by the divert valve and use for disinfection purposes. The water after the carbon filter is the pure, bottled quality water free of chlorine, germs, bacteria, crisp and tasty.

GENERAL BACKGROUND DISCUSSION

Chlorination and filtration water treatment systems kill most of bacteria that cause disease. However, some pathogens are resistant to chlorine, including L. pneumophila, the pathogen that causes the pneumonia known as Legionnaires disease. Almost all breaks of this disease since 1982 have been found in water distribution system.

According to the United States Environmental Protection Agency, from 1970 to 1990, over 140,000 people in the United States became ill as a result of 520 documented cases of contaminated water.

Without chlorine, there would be many more outbreaks and epidemics from waterborne pathogens. But chlorine has the dark side. Chlorine reacts with by-products of organic material to form groups of chemicals called trihalomethanes. One such trihalomethane, chloroform, is a

suspected carcinogen, cancer causing agent. Drinking water treated with chlorine could be causing more then 500 cases of cancer and about 140 deaths in Ontario each year, the Health Canada study reveals.

Other studies have shown some domestic filtering systems can create other bacteria. Unless they are properly maintained, water coolers and water filters may thus actually worsen the microbial and chemical quality of tap water, said the report from the Health Canada Study. The Clinton Administration's Clean Water plan the United State Senate's Water Bill would broaden the Environmental Protection Agency powers to ban or restrict releases of the most persistent toxins. Water toxins in particular chlorine and chlorinated compounds, are being targeted. A chlorine ban could be, in fact, be written into the Bill.

There are a lot of attempts and activities in the recent years in a view of solving chlorine problem in the water treatments.

A number of patents related to ozone and ultraviolet radiation water treatments describe the methods and apparatuses that solve chlorine problem in respect of water purification.

United States Patent 4,230.521, October 1980, to Mr. Dado describes the method and apparatus for the purification of water with ozone and ultraviolet radiation. According to the patent description ozone in water "acts directly to kill bacteria and viruses and to oxidize undesirable compounds in the water."

The similar results indicated in other patents, such as United States Patent 5,266,215, November, 30, 1993, Water Purification Unit, to Engelhard, Role, patent 5,547,590, August, 20, 1996, UV-based Water Decontamination System, to Szhbo, Louis, early patents 4,273,660, 4,274,920 June, 1981 to Mr. Beitzer, 4,619,763, October 1986, to Mr. O'brien, 5,082,558, January, 1992, 5,207,993, 5,213,773, May, 1993 to Mr. Burns, 1,892,712 January, 1990 to Mr. Robertson, 5,106, 501, April, 1992 to Mr. Yang; 5,178,758; January, 1993 to Mr. Hwang.

However, the purpose of the treatment described in the above mentioned patents is to get the high quality drinking water with the amount of ozone or UV - radiation is just sufficient to kill bacteria and remove chlorine and oxidized substances at the stage of filtration.

The preset invention proposes two stream apparatus that produces the water containing ozone for the surface disinfection and the high bottled quality drinking water. The divert valve divides ozone treated water flow in two streams: water with safe ozone residual and water after the carbon filtration stage where ozone mostly is absorbed by filtration media and enter the tap as a pure water, virtually free of contaminants and ozone.

SUMMARY DISCUSSION OF THE INVENTION

The main objective of the present invention is to provide effective, reliable, easy to use, water treatment system to each household. The invented concept and apparatus are designed to use the highly disinfecting abilities of ozone in conjunction with the activated carbon filtration. Ozone is much more powerful than chlorine, oxidizing any viricidial agents used in drinking water treatment. Its effects of elimination of organics, unpleasant taste, odour and colour have been described widely. However, ozone must be produced on site and introduced into the water for the disinfection purposes.

The theory behind the concept of the proposed apparatus based on specific features of ozone as an sterilization agent. When ozone is mixed with water it attacks and destroys bacteria, oxidizes the organic contaminants, removes gases, unpleasant odour, colour and chlorine, leaving only the pure taste of clean water.

The invented apparatus comprises the process of ozone production from the clean, dry, ambient air, ozone injection and complete mixing with in-coming water, storage and contact timing process of dividing the main water flow into tow streams by the divert valve and process of the filtration with the help of a carbon filter.

The prototype of the apparatus has been built to study the specific operating and maintenance conditions. The municipal chlorinated water supply was the prime subject of study. The corona discharge ozone generator has constantly produced the calculated amount of ozone that introduced into the storage tank through injector where ozone is mixed with chlorinated municipal water. The introduction of ozone into the water containing residual of chlorine caused the drop in chlorine content, resulting from following chemical reaction:

$2CLO2 + O3 = 2CLO3 + O2$

The action kinetics of ozone with chlorine dioxide are very fast. The resulting products of this oxidation reaction is chlorate which is easily filtered out at the next treatment stage. The best results have been achieved during experiments when ozone was introduced into the cold water with temperature about 41 degrees Fahrenheit or 4 degrees Cent. At this conditions ozone was dissolved faster inside the water, confirms the data, see Table 1, and stayed composed longer, about one hour, providing the best conditions for disinfection and interaction with chlorine.

TABLE 1

Temperature (degrees Cent.)	Solubility of Ozone (liter/liter Water)
0	0.64
4	0.58
11.8	0.5
15	0.456
19	0.381
27	0.27
40	0.112
55	0.031
60	0

The making temperature range for the invented apparatus is underlined in Table 1. The specified feature of the invented apparatus is that ozonation process taking place under the water pressure in a range of thirty to eighty pounds per minute which creates food conditions for solubility of ozone in water based on Henry's Law and its fundamental relationship governing the solubility of ozone in water. Practically, pressure water system as proposed by present invention, along with ozone/water injector, allows to design very compact, easy to handle ozone water purifier, as invented ozonated water supply purifier.

The government clean water regulations require to maintain dissolved ozone residual of 0.4 milligrams per liter for a minimum of four minutes to get high quality drinking water. The value of "CT" criteria where 'C' - ozone residual in water in milligram per liter, 'T' - time of treatment in minutes, is recommended in a range of 1.5 to 5 and up. For example, CT = 0.4 x 4 = 1.6, where C = 0.4 milligrams per liter, and T = 4 minutes.

The invented apparatus is designed to maintain above mentioned criteria, CT at the level recommended by the government's Clean Water Act. However, test results of the said apparatus, test results of the said apparatus shows that bacteria eschirchia coli taken as an indicator organism in amount of 1×10^7 colony forming units per millimeter had been killed in two minutes. After the study at the laboratory the prototype of the ozonated water supply system had been installed in the kitchen area. For the more then one year of testing apparatus had provided and still providing pure, free of chlorine, high quality drinking water.

Another unique feature of the invented apparatus is the longer, between service time, live of the carbon filter. It happens as ozone treatment kills bacteria before filtration stage, unlike to the conventional filtration process when bacteria is retained on the filtration surface(s) and start multiplying unless filter is changed in time. In case of the invented apparatus, harmful bacteria does not build up in the filter or if it happens incoming ozone containing water kills bacteria that reducing filter replacement and maintenance schedule.

DESCRIPTION AND PRINCIPLE OF OPERATION

The flow diagrams of possible equipment arrangement of the Ozonated Water Supply Purifier are shown in Figures 1,2,3. The general views of the said apparatus of various capacities are shown in Figures 4,5. Figure 1 shows the small capacity apparatus that could be installed in any kitchen, under the sink, to provide the ozone cotnaining water for the washing and disinfection and the quality drinking water.

Water from the municipalities or community supply comes through the stop valves 1,2, solenoid valve 3, pressure switch 4, into the injector 5. Vacuum created in the injector 5 draws ozone produced by ozone generator 6 into the water line. Mixing process of water and ozone

happens inside injector 5, water lines and contacts tank 8. The fresh dry air enters the corona discharge ozone generator through the dryer 7. Treated flow of water from the tank 8 is divided into two streams with help of tee 9. One stream goes through the carbon filter 10 to the faucet valve 11. By turning divert valve 11 pure drinking water enter the faucet 13. Pure drinking water line is connected to the refrigerator 14 through the solenoid valve 15 to provide water for ice maker.

Under the sink ozone water purification system for bathroom is shown in Figure 2. The diagram shows the ozone containing cold water enter the mixing valve 16 to be mixed with not water to get warm like water mixture to be use in special shower to wash the private parts of the body. The ozone purification for the whole house is shown in Figure 3. The flow of ozone treated water from the large capacity tank 22 goes into two streams: one stream of drinking water after the carbon filter 10 enter the faucet 13 by turning divert valve 11. Another stream of ozone containing water enters the sediment filter 20 and through the valve 12 goes into faucet in the kitchen sink, through the valve 21, goes to the toilet, through the mixing valves 16,16a, to the shower 19 or to the special shower 17 to wash private parts of the body.

The ozone treatment process is started by turning on of any of the following valve 11,12,16,21. The water consumption causes the pressure drop in the water lines. When the pressure drop reaches the set point of the pressure switch 4 it opens the solenoid valve 3 and switch on the corona discharge ozone generator 6. The water treatment process is stopped when the water flow through the valves 11,12,16,21 stops. The pressure switch 4 closes solenoid valve 3 and switches off the ozone generator 6. The operation is completely automatic - treated water flows just by turning the faucet, shower or other tap valve(s) - operates only when water is drawn from the tap.

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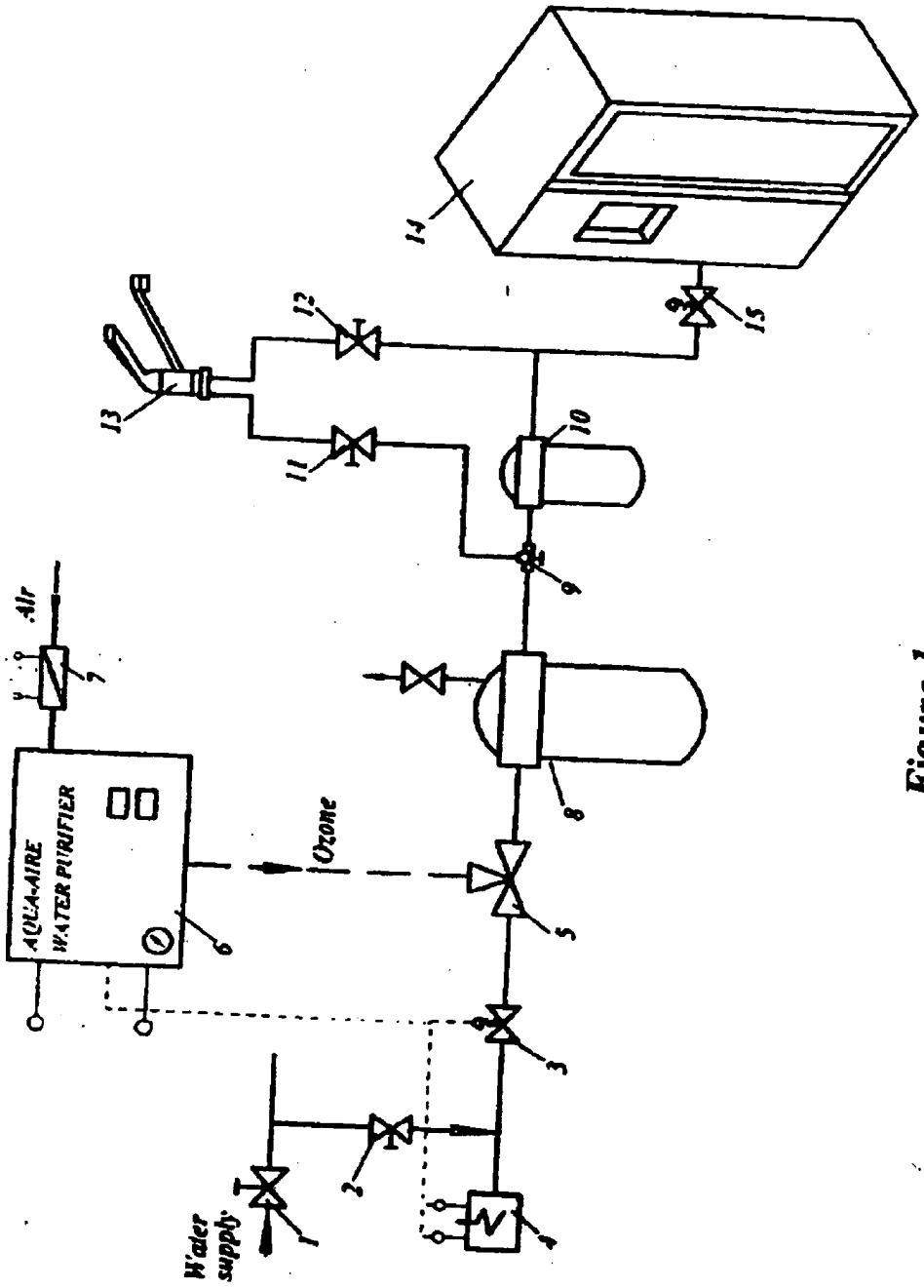

Figure 1

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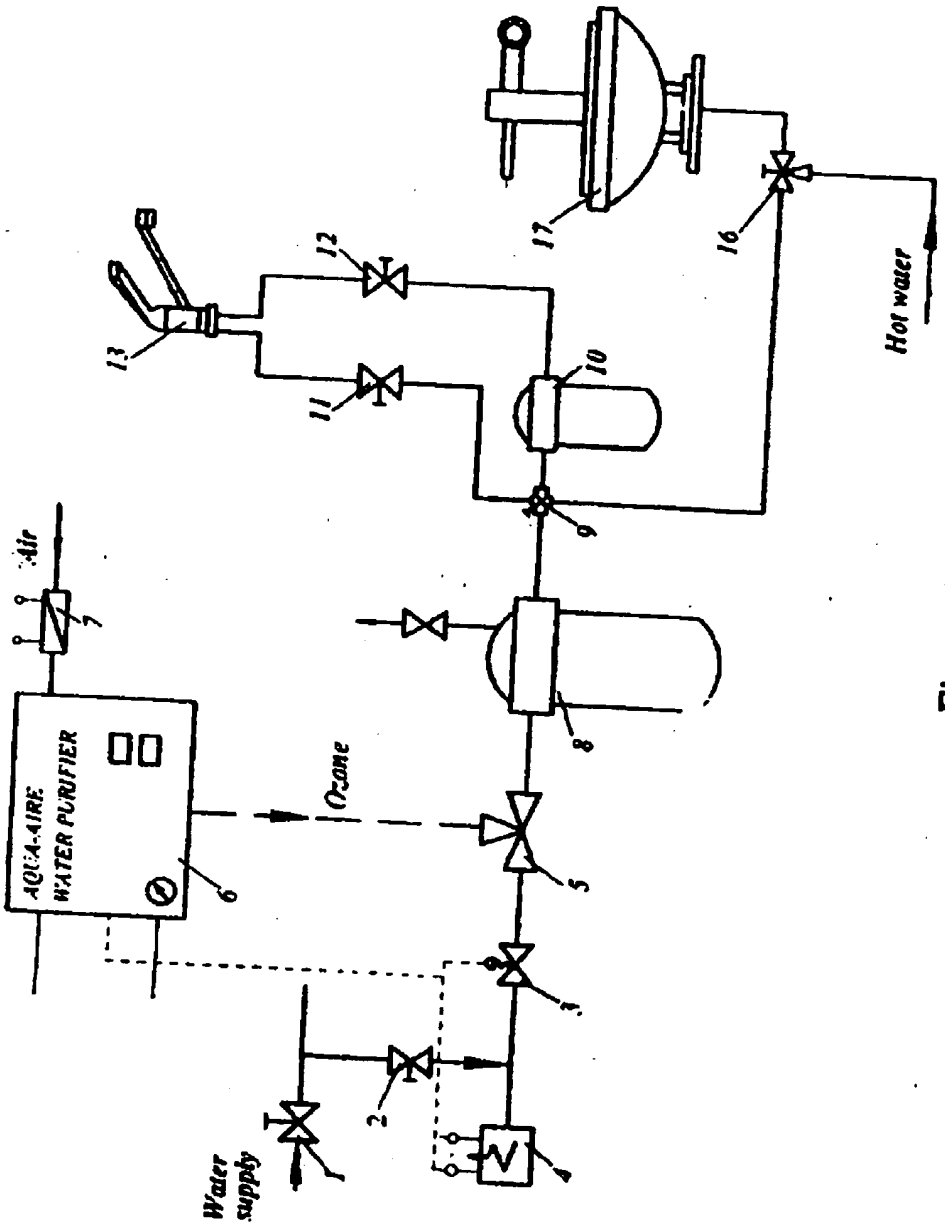

Figure 2

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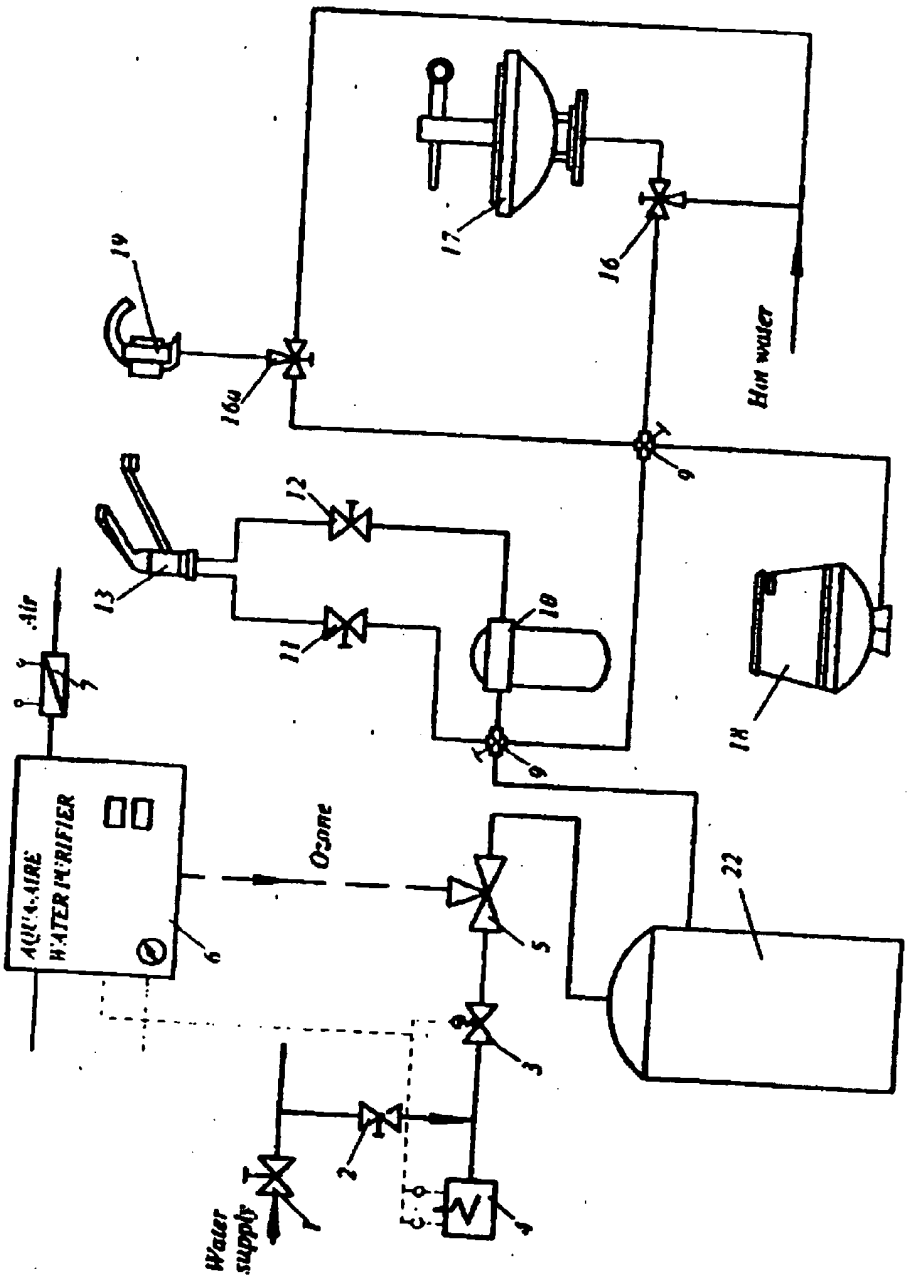

Figure 3

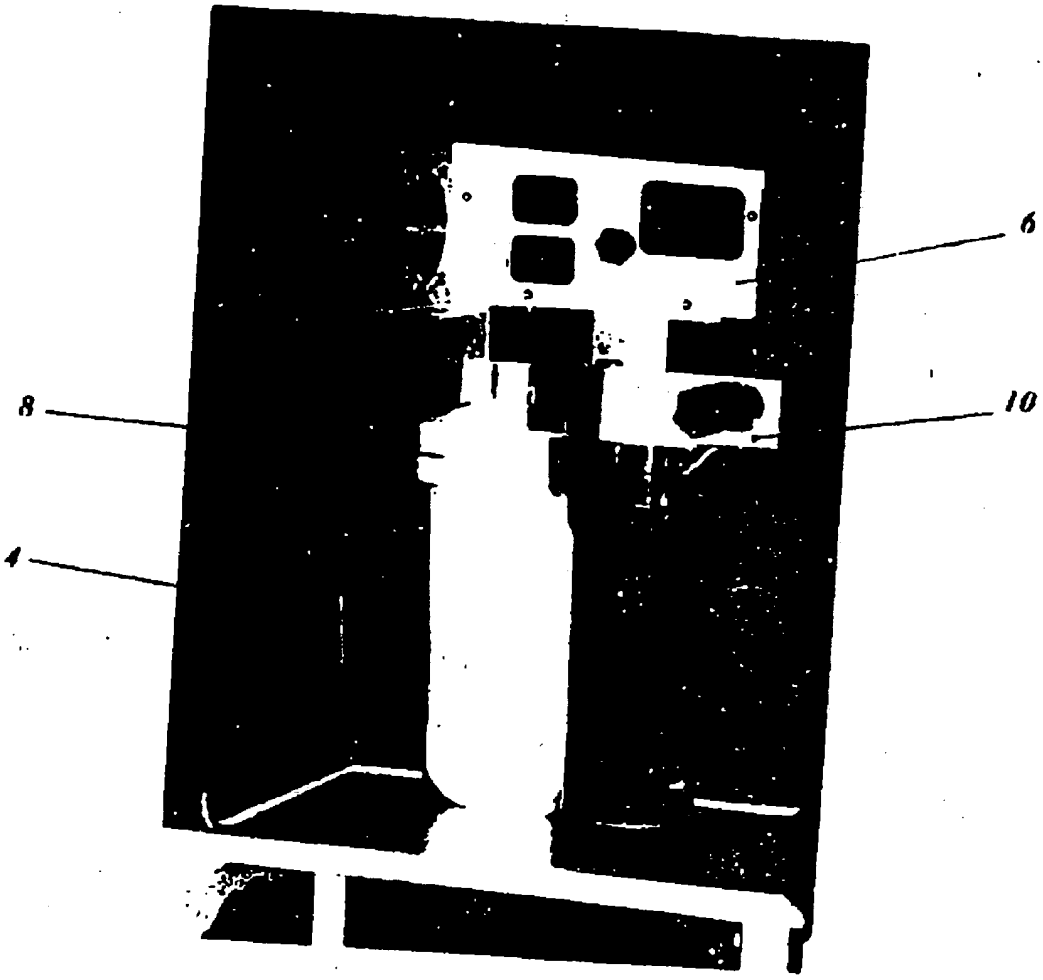

Figure 4

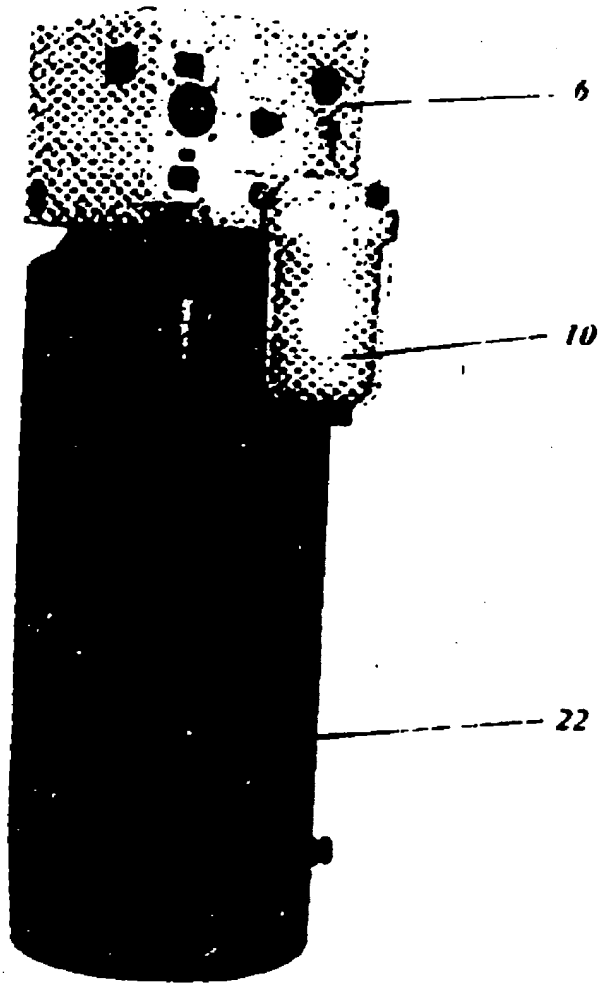

Figure 5